

SPACE TECHNOLOGY 5 (ST-5) OBSERVATIONS OF THE IMBALANCE OF REGION 1 AND 2 FIELD-ALIGNED CURRENTS

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Space Technology 5 (ST-5) is a three micro-satellite constellation deployed into a 300 x 4500 km, dawn-dusk, sun-synchronous polar orbit from March 22 to June 21, 2006, for technology validations. In this study, we use the in-situ magnetic field observations from Space Technology 5 mission to quantify the imbalance of Region 1 (R1) and Region 2 (R2) currents. During the three-month duration of the ST5 mission, geomagnetic conditions range from quiet to moderately active. We find that the R1 current intensity is consistently stronger than the R2 current intensity both for the dawnside and the duskside large-scale field-aligned current system. The net currents flowing into (out of) the ionosphere in the dawnside (duskside) are in the order of 5% of the total R1 currents. We also find that the net currents flowing into or out of the ionosphere are controlled by the solar wind-magnetosphere interaction in the same way as the field-aligned currents themselves are. Since the net currents due to the imbalance of the R1 and R2 currents require that their closure currents flow across the polar cap from dawn to dusk as Pedersen currents, our results indicate that the total amount of the cross-polar cap Pedersen currents is in the order of ~ 0.1 MA. This study, although with a very limited dataset, is one of the first attempts to quantify the cross-polar cap Pedersen currents. Given the importance of the Joule heating due to Pedersen currents to the high-latitude ionospheric electrodynamics, quantifying the cross-polar cap Pedersen currents and associated Joule heating is needed for developing models of the magnetosphere-ionosphere coupling.